Direct imaging of current driven antiferromagnetic domain switching in CoO/Pt bilayer

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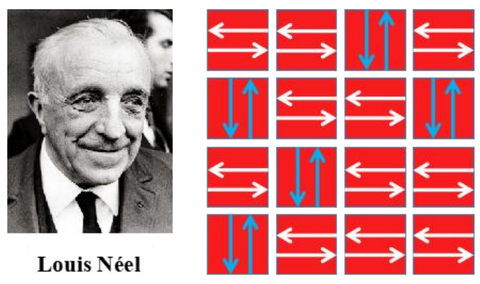
Background

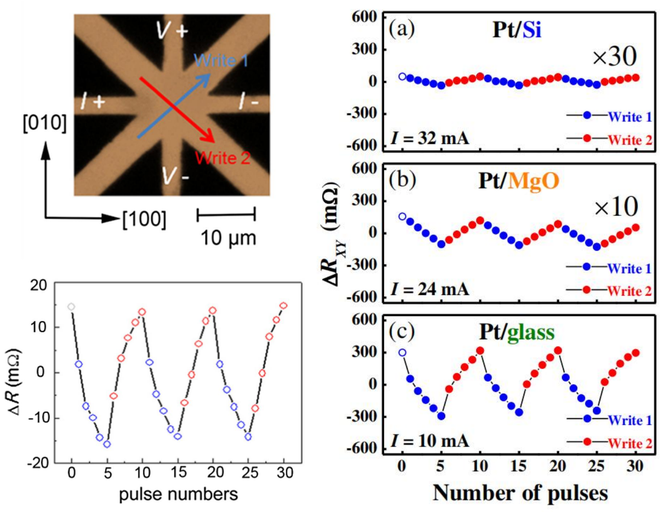
Antiferromagnetic Spintronics



- ✓ High-density data storage
- ✓ Absence of stray fields
- ✓ Ultrafast dynamics (THz)
- ✓ High energy efficiency
- .....

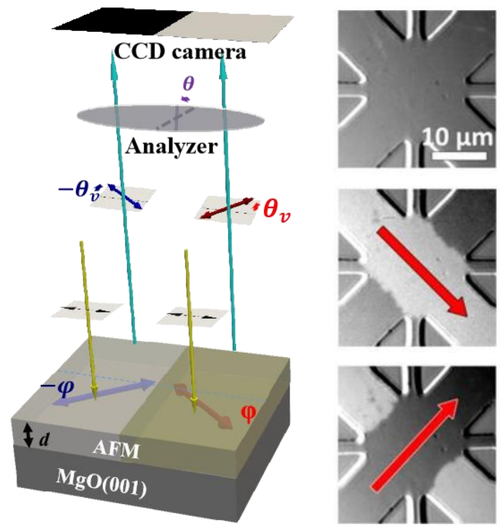
➢ **Attractive and promising!**

Electrical detection of AFM domain switching

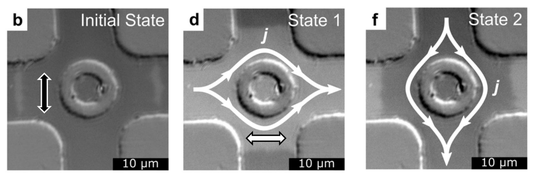


➢ **Non-magnetic origin?**

Direct imaging of AFM domain switching in NiO



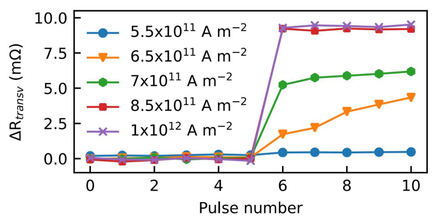
➢ **Real domain switching!**



$n \parallel j$ **Magnetoelastic origin!**

➢ **CoO**

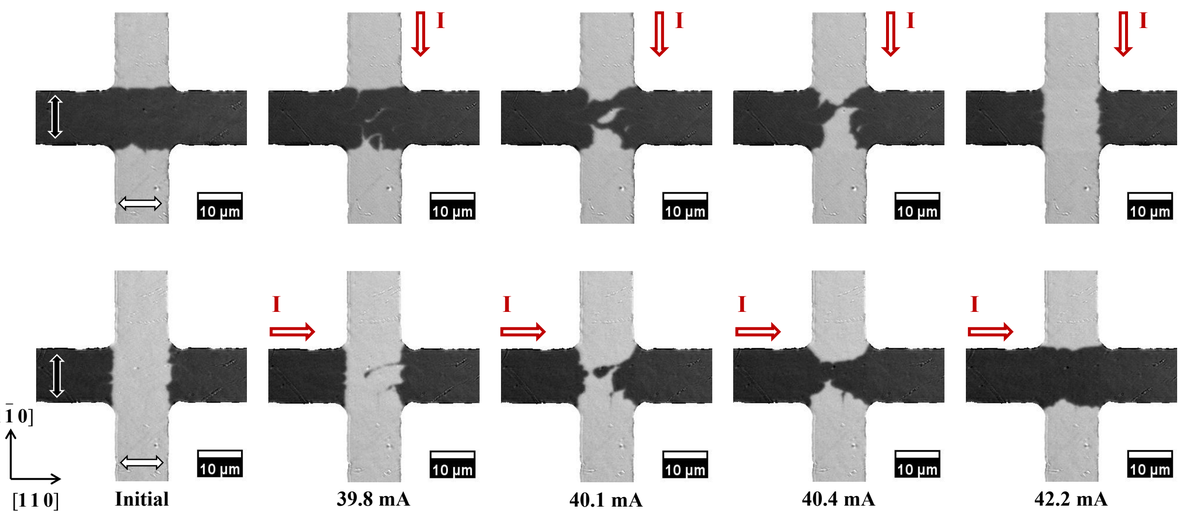
$n \perp j$



AFM domain switching in CoO?

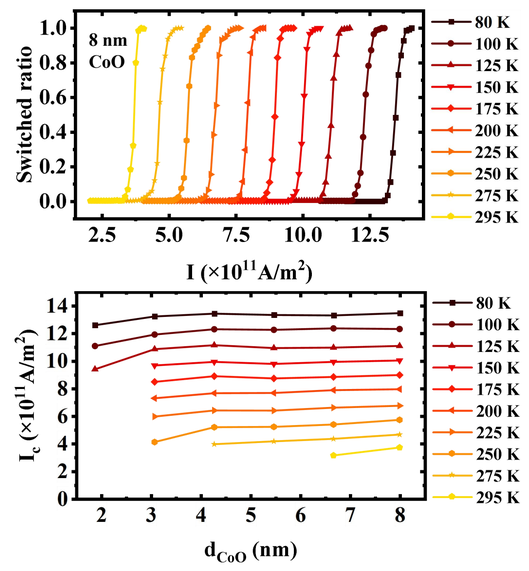
Current driven antiferromagnetic domain switching process

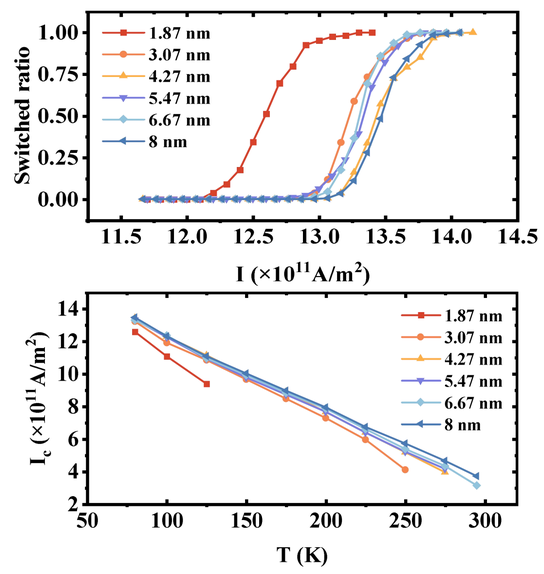
➢ **Typical switching process d_{CoO}=8 nm at 80 K**



➢ **Evidence of current driven switching of CoO domains with $\vec{n} \parallel \vec{j}$**

➢ **Temperature and thickness dependence switching analysis**

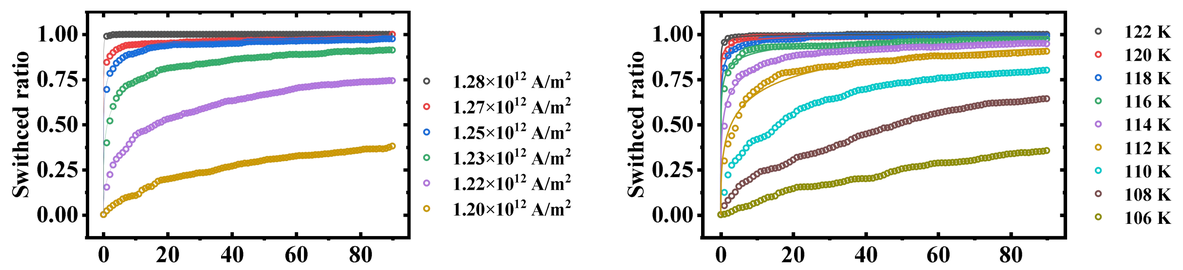




➢ **Independent of d_{CoO}. Magnetoelastic dominant switching process.**

Further analysis on switching process

➢ **Switching with fixed current density and temperature**

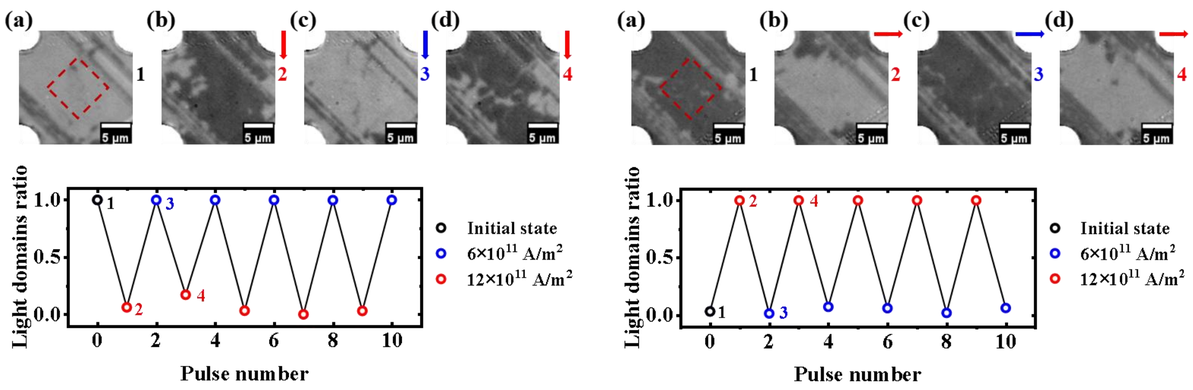


➢ **Higher current density could help domain wall motion across pinning sites.**

➢ **Switching polarity reversal at high current density**

✓ **[1-10] switching**

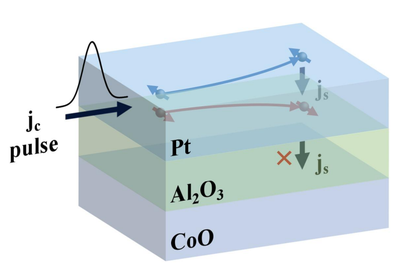
✓ **[110] switching**

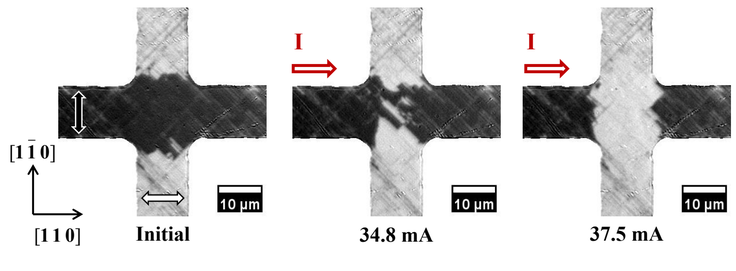


➢ **Probably due to the current distribution inhomogeneity at higher density.**

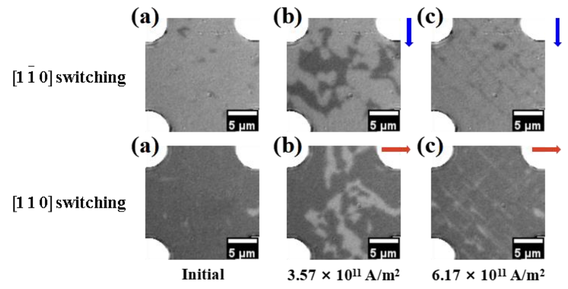
Excluding spin-orbit torque contribution

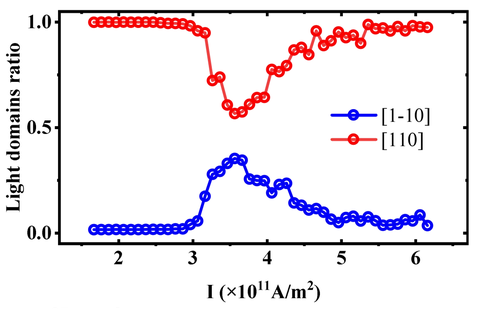
➢ **Typical switching process d_{CoO}=8 nm at 80 K**





➢ **Switching polarity reversal at high current density**





➢ **Excluding SOT contribution**

Summary

- ➢ **Magnetoelastic dominant current driven switching of AFM domains were demonstrated by direct imaging.**
- ➢ **Switching polarity reversal was observed in CoO with higher current density.**